Unicompartmental Knee Arthroplasty (UKA)

Systematic Review / Meta-Analysis

Submitted for Partial Fulfillment of Master Degree in Orthopaedic Surgery

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

﴿ اقْرَأْ باسْمِ رَبِّكَ الَّذِى خَلَقَ ۝
خَلَقَ الإِنسَانَ مِن عَلَقٍ ۝
اقْرَأْ وَرَبُّكَ الأَكْرَمُ ۝ الَّذِى عَلَّمَ
بالْقَلَمِ ۝ عَلَّمَ الإِنسانَ مَالَمْ يَعْلَم﴾

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
AAOS	American Academy of Orthopedic Surgeons
ACL	Anterior cruciate ligament
ACR	American College of Rheumatology
ANA	Anti Nuclear Antibodies
AP	Anteroposterior
BME	Bone Marrow Edema
ECM	Extracellularmatrix
HA	Hyaluronic acid
HTO	High tibial osteotomy
JSN	Joint space narrowing
KSS	Knee Society Score
LCL	Lateral collateral ligament
M_{add}	Peak knee adduction movement
MCL	Medial collateral ligament
NSAIDs	Nonsteroidal Anti-Inflammatory Drugs
OA	Osteoarthritis
OARSI	Osteoarthritis Research Society International
OKS	Oxford Knee Score
PCL	Posterior cruciate ligament
PF	Patellofemoral
PFOA	Patellofemoral osteoarthritis
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analysis
REM	Random-effects method
RF	Rheumatoid Factor
ROM	Range of motion
SE	Standard error
TF	Tibiofemoral
TKR	Total knee replacement
UKA	Unicompartmental knee arthroplasty
UKR	Unicompartmental knee replacement
VAS	Visual analogue score

INTRODUCTION

In the early 1950s, McKeever first conceptualized the notion that osteoarthritic disease could be isolated to one compartment of the knee joint. He concluded that the entire knee joint did not need to be replaced when faced with isolated compartment disease. On the basis of these principles, McKeever inserted his first unicondylar replacement in 1952, which was metallic and used a pin for fixation. McKeever's concept led to the use of the first cemented unicondylar replacement, which was inserted in the United States in 1972.[1,2]

Physical and radiographic evaluation remains the cornerstone in the diagnostic process of knee osteoarthritis (OA) and is particularly important to assess whether a knee with unicompartmental OA (medial or lateral) would be indicated for UKA (unicompartmental knee arthroplasty). Evaluation of the presence of unicompartmental knee OA through medical history, physical examination and imaging is essential and all contribute to precise patient selection. Furthermore, it provides valuable information in surgical decision-making after diagnostic criteria are met.[3,4]

Kozinn and **Scott's** 1989 original inclusion criteria (1989) included that the patient had to be older than 60 years at the time of surgery, weigh <82kg, should not be physically active or performing heavy labour and have movement-related pain. Furthermore, during physical examination, the patient needed to have a preoperatively flexion of the knee of more

than 90°, maximum flexion contracture of 5°, varus or valgus deformity of <15° and passively correctable to neutral. Although strict adherence to these recommendations led to the improvements of the results, the criteria were generated at a time that surgical techniques and implant designs were not yet optimised. Therefore, questions arise whether these criteria should still be used today or can be extended. [5,6,7]

Regarding physical examination, to assess whether or not a patient is indicated for **UKA** depends on many factors. It is important to evaluate the location of the pain over the joint line (medial or lateral),range of motion(ROM), leg deformity, state of the anterior cruciate ligament (ACL) and patellofemoral (PF) discomfort. Pain should be isolated to one compartment, either medial or lateral, to be indicated for UKA. Assessing knee stability, the Lachman or anterior drawer test can be used to evaluate the integrity of the ACL clinically. Furthermore, varus and valgus stress tests assess the collateral ligaments and amount of correctability of a leg deformity if present. [7,8]

Traditionally, knee OA is diagnosed on anteroposterior (AP) and lateral weight-bearing radiographs of the knee. Additional lower leg alignment radiographs are performed as part of the standard radiological work-up of patients with unicompartmental knee OA. For evaluation of the patella and trochlear surfaces of the femur, an adequate Merchant view may be helpful in determining gross malalignment and presence of PFOA. [8]

The radiographic indications for **UKA** is unicompartmental knee OA, with preservation of the contralateral compartment as shown on weight-bearing and valgus/varus stress radiographs.Preoperatively, stress view radiographs could provide information by means of determining correctability of the deformity, ensuring maintenance of the contralateral joint space, and indirectly assessing the integrity of the ACL and medial collateral ligaments. Advocates of stress radiographs require the deformity to be correctable to neutral, with preservation of the contralateral joint space. However, a preoperative MRI is used more often to document the absence of significant degenerative changes in the contralateral or PF compartment. [9,10]

Currently, the total usage of **UKA** ranges from 8% to 11% according to UK registries. Over the past two decades, advances in implant design and surgical technique have generated promising survivorship rates, faster recovery and rehabilitation, increased pain relief and good postoperative ROM. As a consequence of these results, an increase in application of **UKA** is expected. However, orthopaedic surgeons need to be aware of the possibility of **UKA** for treating isolated knee OA. Out of 200 consecutive patients, 47.6% was a potential candidate for **UKA** based on radiographical findings, hence the conclusion that **UKA** has to be considered as a treatment option more often in the future. **(11,12)**

AIM OF THE WORK

This study aims to review the currently available evidence for proper management of knee osteoarthritis using unicompartmental knee arthroplasty.

This review will show different literature, research & statistical analysis of results concerned with **UKA**.

REVIEW OF LITERATURE

Evolution

The concept of hemiarthroplasty of the knee for the treatment of medial TF (tibiofemoral) degenerative joint disease dates back to the 1950s, when it was developed in order to prevent direct bone-on-bone apposition and provide satisfactory pain relief.[13]

The real pioneer was Campbell, who, in 1940, reported his primary results on the interposition of vitallium plates in the medial compartment of arthritic knee [13]. Thereafter, McKeever [14] in 1957, introduced his vitallium tibial plateau prosthesis. Then, in 1958, came MacIntosh's tibial plateau: which was initially acrylic, but was followed, in 1964, by a vitallium one. MacIntosh et al. [13] presented their preliminary results in Switzerland in 1967, while in 1972, a manuscript was published demonstrating "good results" in terms of overall pain relief in most patients at a mean follow-up of six years [15]. MacIntosh noted that the lack of fixation could lead to migration of the device in the unsatisfactory results group. To overcome this problem, McKeever added a keel to his tibial plateau prosthesis. In the early 1970s, the Gunston and polycentric unicompartmental knee arthroplasty devices were introduced. The revision rate of these early devices at two years was approximately 10%. Modern UKR implants really started with Marmor [16], who introduced his modular hemiarthroplasty in 1972 and in 1979 reported a high success rate in 56 patients

followed up for a minimum four-year period[16]. This was also the period in which the St. Georg sled was introduced in Germany, and in 1976 Engelbrecht et al. [17] reported that 85% of 294 patients achieved a good result after a four-year follow-up. Other authors also produced good initial results following unicompartmental procedures: Scott et al. [18]reported early success with the Brigham prosthesis. Subsequently, both Larsson and Ahlgren [19] and MacKinnon et al. [20] confirmed satisfactory results with the St. Georg sled[20]. Various authors, from 1973 to 1983, reported success rates varying between 37% and 92 with two- to eight year follow-ups. From 1987 to 1991, long-term results were published, showing 87% to 90% survivorship at 13 to 16 years[21,22]. However, several studies in the 1970s cast doubt on the benefits of UKA as a surgical option for knee OA. In 1980, Insall and Aglietti [23] reported on a series of 22 UKAs that, having been initially successful, had started to fail at the six-year review. Laskin [24] noted poor results with the Marmor prosthesis, and Bucholz and Heinert [25]recorded a high failure rate with the St. Georg sled. A review of these articles suggested that inappropriate patient selection was a major contributory factor since many of the Insall and Aglietti group had undergone prior patellectomy, and in Germany the prosthesis had frequently been used for bicompartmental disease and often in the presence of rheumatoid arthritis and joint instability. These papers and later reports of mechanical failure of certain prostheses, such as the Brigham one, due to thin polyethylene and possible edge contact, led to widespread and growing skepticism about the

wisdom of using a UKR. Moreover, at the same time, the outcome of TKR was becoming increasingly satisfactory, reproducible and reliable. As a result, in North America and the United Kingdom many surgeons almost abandoned the UKR as an option for the management of unicompartmental OA of the knee and the two principal surgical options became proximal HTO(high tibial osteotomy) and TKR, the latter being indicated as the easier and more reliable procedure, always to be performed in knees where an arthroplasty was necessary. [26,27]

Anatomy and biomechanics

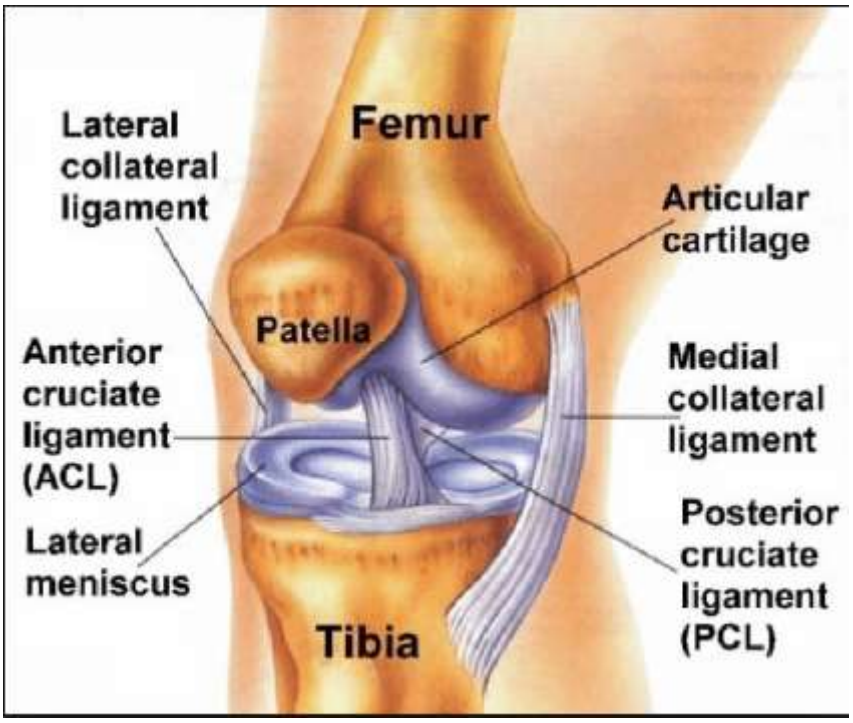

Figure (1): The human knee joint anatomy with visual cruciate ligaments. [28]